Dr. Tupper thus describes its effect: "Within a short time, ordinarily within one-half hour, there has been a free passage of flatus accompanied, not infrequently, with a fecal evacuation. Apparently the salt acts directly upon the rectum and lower sigmoid, causing relaxation of the muscular coat without producing peristalsis of either the large or the small intestine. Because of this the therapeutic measure is safe and especially serviceable soon after operations upon the intestine where evacuation of flatus is necessary for the patient's comfort and safety and where active peristalsis might produce serious results.

"Magnesium sulphate thus applied apparently is more effective than the enemata ordinarily used and is apparently free from the discomfort and danger accompanying their use."

I wish to express my thanks to Dr. R. Walter Mills for the roentgen-ray work and to Dr. D. L. Penney for valuable aid in the treatment of the cases.

Conclusions. 1. Spastic contractures of the lower colon are etiological factors in many cases of chronic constipation.

2. These contractures are the result of disturbances in Meltzer's law of contrary innervation.

3. A saturated solution of magnesium sulphate applied locally to the contracted segment produces a relaxation. Repeated applications finally overcome the spasticity and permit the restoration of normal colonic function.

4. Contractures in the rectum and lower sigmoid, with accompanying dilatation of the colon, are found in many cases of postoperative abdominal distention. Magnesium sulphate enemata are very efficacious in relaxing the contractures and thereby relieving the distention and "gas pains."

5. Enemata of magnesium sulphate are also very useful in partial organic obstructions in the rectum and lower colon, inasmuch as they relax accompanying muscular contractures without stimulating peristalsis.

6. Magnesium sulphate solution applied by means of the cotton applicator greatly facilitates the introduction of the sigmoidoscope.

SARCOMA OF THE HEART.

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Introduction. Of the various organs of the body the heart is the least frequent site of primary neoplastic change. Tumors of the heart are therefore of pathological interest because of their rarity. They should excite a certain degree of clinical interest because there arises the question of the possibility of making a clinical diagnosis of cardiac tumor. As a matter of fact, tumor of the heart has never been diagnosed, *intra vitam,* as is apparent from a review of the literature of the subject.

Primary tumors of the heart are of less frequent occurrence than secondary tumors. The latter most often reach the heart by direct contiguity from tumors of the mediastinum and from tumors of the lungs, of the pleura, of the sternum, of the stomach, etc. They may also be carried to the heart from some distant organ, but this occurs infrequently. Metastases in the heart have been reported from malignant growths occurring in practically any part of the body, as cancer of the breast, of the stomach, penis, uterus, of melanotic sarcoma of the eye, etc. Tumors of the adrenals have been found to reach the heart by progressive sarcomatous thrombosis. Secondary tumors are more often carcinomas than sarcomas.

The first who called attention to the presence of a tumor of the heart, according to Tedeschi,[1] was Theophy Boneti, who found such a tumor, together with marked edema of the lungs, as reported in *Sepulchretum sivi anatomia practica ex cadaveribus morbo donatis,* Geneva, 1700, JIII, Miscellania, p. 505. Morgagni, in 1762, described numerous polypoid formations in the heart. (*De sedibus et causis morborum,* etc. Epist. XVI, Napoli, 1762.) We have no criterion as to the exact nature of the tumors described by these older writers. We do not know whether they were real blastomas or only blood-clots and organized thrombi, but we have to consider the possibility that they may have been real neoplasms.

The first authentic report of a primary cardiac tumor is that of Albers, who reported a primary cardiac "chondroid" in 1835, and later[27] corrected his diagnosis according to the progress which had been made in pathology, and called it a fibroma. The first sarcoma was reported by Bodenheimer in 1865. In looking over the literature one finds that more than 100 cases of primary tumors of the heart have been reported, but many of these must be rejected because they are not true tumors or are not primary in the heart.

Tedeschi,[1] reviewing the literature on this subject, counted up 86 cases, including 3 of his own. Unquestionably many of these cases are secondary tumors. Berthenson[2] found only 30 cases of unquestionable primary tumors, and his resumé dates from the same year. Among these 30 tumors were 7 sarcomas. Link[3] was able to collect 91 cases, but only 23 were of value from a clinical point of view. In his list are 13 sarcomas. Ehrenberg[4] collected 19 cases of sarcoma of the heart.

Among 2942 autopsies performed at the Johns Hopkins Hospital were found 10 heart tumors. These were all secondary except one rhabdomyoma. They were 1 sarcoma, 1 lymphosarcoma, 2 epitheliomas, 1 endothelioma, and 4 carcinomas (Bryant).[5] From 1903 to 1907 there were 6655 autopsies performed at the Pathological Institute of the University of Berlin. Among these were found 15 secondary carcinomas of the heart and 4 secondary sarcomas (Karrenstein).[6]

Many of the older writers report cancers of the heart. Indeed, it appears as if they called any malignant growth of the heart a cancer. These reports date back mostly to the premicroscopic days, and they are of little value to us from a pathological point of view. A carcinoma of the heart of a child of three days was reported by Billard in 1828, and Andrale and Boyle in 1824 reported a case of a carcinoma in the wall of the right ventricle (cited from Schöppler).[7]

However, primary carcinomas of the heart have been reported quite recently. Dietrich[8] reported a growth the size of the palm of a hand on the anterior and right mediastinal surface of the upper part of the pericardium in a woman, aged forty-four years, who died suddenly after having suffered for two months with dyspnea and anxiety without real heart difficulties. This tumor, a papillary carcinoma, did not infiltrate the myocardium, and the author considered it to be a primary carcinoma originating in the parietal pericardium, for no focus was found after careful search in any part of the body. Foerster and Garnieri[9] also reported a case of primary carcinoma of the pericardium (*Un caso de cancero endotheliale primitivo del pericardio*). It is difficult to understand how a primary epithelial tumor could originate in an organ which does not contain any epithelial tissue, unless the tumor has originated from the covering pericardial mesothelium.

The most common tumors of the heart are fibromas, myxomas, and fibromyxomas. Next in frequency are the sarcomas. Rhabdomyomas, lipomas, angiomas and lymphangiomas also have been reported. A teratoma has been reported by Joel.[10] This tumor was within the pericardial cavity attached to the pulmonary artery where it leaves the heart. Of special interest are the rhabdomyomas. They are a characteristic, well-defined group. Usually they are congenital, and in about 50 per cent. of the cases they are associated with a tuberous sclerosis of the brain.

Of late years the fibromas and the fibromyxomas have attracted special attention. According to several investigators, as Thorel, Stahr and others, many of this class of tumors reported as primary are not genuine blastomas but pseudotumors, namely, organized thrombi which have undergone a certain metamorphosis by edematous changes and formation of elastic fibers. Méroz,[11] in 1911, reported 3 primary heart tumors which were found among 3000 autopsies. Two of these he diagnosed as fibro-élastomes hemorrhagiques and the third one as a sarcoma. The first 2 are considered by Thorel as organized thrombi. There is no question but that many of these tumors are nothing but organization tissue.

The origin of these neoplasms may be in any of the layers of the heart wall, in the endocardium, the myocardium or the epicardium. Some of the tumors reported had their origin in the parietal pericardium, but the majority originated in the endocardium. Link,[3] in his report of 91 cases of primary tumor, pays special attention to the site of the tumor. He finds that 24 among this number were located in the left auricle, 10 in the right auricle, 14 in the right ventricle and 8 in the left ventricle. Sixteen were valve tumors; 3 were situated in both auricles; 2 in both ventricles; 2 in the right auricle and ventricle; 2 in the left auricle and ventricle; 2 only in the auricular septum.

According to the type of cell of which they are composed, sarcomas of the heart are classified as round-, spindle-, mixed- and giant-cell sarcomas, and with regard to their structure they may be plain sarcomas, myxosarcomas, fibrosarcomas and angiosarcomas. An osteosarcoma and a sarcoma lymphangiecticum have been reported in dogs.

The etiology is of course unknown. Ribbert thinks they may be due to superfluous cell material in the auricular septum due to disturbances in development. The reason for the rare occurrence of cardiac tumors is, according to Adami,[12] that "The heart above all organs is constantly in a state of great efficiency, well nourished, well innervated and functionally always active, so that it is less likely to take on aberrant growth."

Symptoms, Clinical Course and Diagnosis. That a clinical diagnosis of tumor of the heart has never been made can be explained by the fact that this pathological condition does not produce a characteristic picture. The diagnosis, which appears to me the most rational, was the one made by Biermer, who diagnosed the case reported by Bodenheimer[13] as "cardiac disease of unknown origin."

From a clinical point of view we may divide tumors of the heart into two groups: (1) those which produce symptoms, and (2) those which do not produce symptoms.

Frequently these patients do not present any, or very few, symptoms suggesting cardiac trouble. Some die suddenly and without having shown any signs of the disease, and the cardiac tumor is then found on the autopsy table as a surprise. In some cases the symptoms appear suddenly and death occurs in a short time. The reason for this may be that a malignant growth of the heart may remain stationary for a long time, the same as an ulcus rodens or a carcinoma of the stomach, and then flare up suddenly and produce severe symptoms and death in a short while, as in the author's case.

The symptoms which are produced by a cardiac tumor depend upon its location and upon its size. We may easily understand that a small tumor located on the surface of the heart, not interfering with the circulation, may not produce any symptoms whatsoever. However, a tumor, even if of a very small size, located on or near a valve, is liable to produce a stenosis of a cardiac orifice or prevent proper closure of the valve, so that soon symptoms of disturbed circulation may arise. When a tumor is large its mere size is apt to produce these symptoms by encroaching upon the cavities of the heart or by pressure upon the large veins. It is evident that these symptoms are produced mechanically. How sudden death may thus be produced is demonstrated by Fuhrman's case. In this case the ostium of the right coronary artery was occluded by a sarcomatous growth, and a sarcomatous embolus was found at the opening of the left coronary artery. In the cases of secondary cardiac tumor, when a focus exists in some part of the body, a metastasis into the heart may sometimes be inferred, when suddenly heart symptoms develop in a previously well-working heart, but even here no certain diagnosis can be made.

As to the diagnosis of cardiac tumors, Hoover[14] states that "it is either impossible or a matter of good fortune." When symptoms are present they are those of heart disease, and the clinician then thinks properly of the more common morbid conditions, "for unless we wish to indulge in the merest guesswork we must hold fast to the principle that in an individual case the probabilities are more in favor of ordinary clinical conditions than of the rarer anomalies."[15]

Several writers have tried to find symptoms which are diagnostic of cardiac tumors, but they did not succeed. Bodenheimer[13] states that "one can think of heart tumor when history, clinical examinations and observation do not speak for any other heart disease, when the symptoms occur rather suddenly and unexpectedly and the condition *soon* takes a faster, *soon* a slower course."

Krehl[15] states that it is suggestive of heart tumor when a marked congestion occurs along the course of one vein, while other parts, which also ought to be affected in the course of ordinary cardiac disease, escape altogether. Fraenkel[16] considers the frequent recurrence of hemorrhagic pericardial effusion, necessitating frequent paracenteses, as a diagnostic symptom of cardiac tumor, and Eichhorst[17] states: "It must be said that tumors of the heart hide themselves sometimes behind the picture of pericarditis." The most important diagnostic means used today are the roentgen-ray picture and the fluoroscope. Only in 2 of the cases reported below (Ehrenberg and Sternberg) were these means used, for most of the cases were reported before we had these means of diagnosis.

Report of Case. The rare occurrence of primary sarcoma of the heart induces me to report the following case of sarcoma which originated in the subepicardial areolar tissue. It is of interest because of its large size, its well-defined structure and on account of the hemothorax which was associated with it.

The patient, a business man, aged forty-three years, entered the Michael Reese Hospital, December 4, 1916, as a private patient of Dr. H. Schiller.* He complained of shortness of breath and cough. He first noticed two weeks previously that he became short of breath easily. He also had a slight irritation in the left side and thought that that caused the cough. After the dyspnea and cough had persisted for one week he consulted a physician, who told him that he had a slight bronchitis, and gave him some cough medicine. When, one week later, he had found no relief he went to Dr. Schiller, who found flatness over the left base and other signs of fluid. By thoracentesis he withdrew bloody fluid and sent the patient to the Michael Reese Hospital. The patient has not had any pain to amount to anything during the course of the disease.

Following is an extract from the hospital records:

Past History. He had pneumonia four years ago. He also had several attacks of influenza with pleurisy.

Family History. Negative. There is no tuberculosis or carcinoma in the family.

Physical Examination. A well-developed, middle-aged man who complains of pain in the left side and of difficult breathing. The head and neck do not show anything abnormal. The pupils are equal and react to light and distance. Chest: There is dulness to flatness over the entire left thoracic cavity, extending almost to the clavicle. No breath sounds are heard here. The heart is pushed to the right for two and a half inches. The heart sounds are normal; no murmurs are heard. The abdomen is distended but not tender. The extremities are negative.

On the first day of his residence in the hospital a thoracentesis was done. One quart of bloody fluid was removed. No organisms were found in this fluid, neither by direct smear nor by cultures on blood agar, bouillon and common agar slants. Ziehl-Neelsen stain for tuberculosis was negative. The cellular elements present were fresh red blood cells, lymphocytes, pus cells and endothelial cells, the red blood corpuscles predominating. 1300 leukocytes were counted per cubic millimeter. Many shadows of hemolized red blood cells were seen. The repeated examinations of specimens of fluid revealed no new information. Altogether ten specimens of bloody fluid were obtained from the left thoracic cavity:

December	4	1000 c.c.
"	6	1000 c.c.
"	7	1800 c.c.
"	10	1900 c.c.
"	13	2700 c.c.
"	15	2400 c.c.
"	16	1900 c.c.
"	17	1300 c.c.
"	18	900 c.c.
"	19	450 c.c.
Total		15,350 c.c.

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* I wish to express my thanks to Dr. Schiller for his permission to publish this case.

Since the pleural cavity filled up so fast after each thoracentesis a thin catheter was introduced and left there for drainage after several thoracenteses had been done. Several times air was injected into the pleural cavity after 500 to 1000 c.c. of fluid had been withdrawn.

An intravenous infusion of 60 c.c. of blood was performed on December 15 and of 50 c.c. on December 16.

Examinations of the sputum for tubercle bacilli were made December 6, 11 and 12. The usual organisms were present and no tubercle bacilli were found.

The Wassermann test was made on the blood December 4, 11 and 15, and found negative each time.

A guinea-pig was injected intraperitoneally with the pleural fluid on December 7. It did not develop tuberculosis.

The patient's temperature on admission was 100° F. and never went over 102.4° The pulse was always over 100. Usually it was between 108 and 120; the highest rate recorded was 130.

In the urine several times a trace of albumin was found and a few epithelial cells or leukocytes.

It is interesting to follow the blood changes with the continual loss of blood:

	Red blood count.	Hemoglobin, per cent.	White count.
December 4	5,080,000	90	21,800
" 6	5,696,000	85	20,000
" 7	5,696,000	..	22,200
" 8	....	..	28,600
" 10	4,867,000	75	27,800
" 12	4,013,000	70	26,000
" 14	3,167,000	50	48,400
" 15	2,987,000	50	112,000
" 16	....	..	134,000
" 17	2,203,000	45	122,000

	Differential count.*								Cells
	N.	S. M.	L. M.	T.	E.	B.	N.	Stain.	counted.
December 4	82	12	6	0	0	0	0	Wright	100
" 8	86	9	5	0	0	0	0	"	100
" 17	89	4	7	0	0	0	0	"	100

The coagulation time on December 9 was 3.5 minutes and on December 10, 3 minutes.

The blood-pressure on December 6 was 115, 90 and 25 mm., and on December 7, 110, 85 and 25 mm.

The pulse was intermittent, weak and irregular; respiration was at times irregular, usually over twenty and sometimes as high as forty per minute. The outstanding symptoms were shortness of breath, profuse perspiration, restlessness, vomiting, nausea, dizziness, feeling of faintness, weakness, thirst and coughing. He died December 21, 1916, at 12.05 A.M.

All these symptoms can be explained by an excessive loss of blood, which is the outstanding and most remarkable feature of this clinical picture. Altogether 15,350 c.c. of bloody fluid were obtained from December 4 to December 19. A definite diagnosis as to the reason for the continued bloody exudate in the pleural cavity was not made. Since the common symptoms of heart disease, as murmurs, edema, ascites, etc., were not present, tumor of the mediastinum and tuberculosis mainly were thought of. No tubercle bacilli were found in repeated examinations of the sputum and the pleural fluid, and tumor of the mediastinum was left as the probable diagnosis.

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* N. = Neutrophiles L. M. = Large Mononuclear B. = Basophile
S. M. = Small Mononuclear T. = Transitional cell N. = Nomoblast
E. = Eosinophile

REPORT OF AUTOPSY. The postmortem examination was performed ten hours after death. The anatomical diagnosis was as follows: Subepicardial sarcoma of heart (mixed cell). Metastases into pericardial fat, pleura and mediastinal lymph glands. Chronic obliterative pericarditis. Left hemothorax. Patent foramen ovale. Arteriosclerosis of ascending aorta. Adipositas cordis. Atelectasis of left lung. Chronic fibrous pleurisy of right lung. Passive congestion of upper lobes of right lung. Lobar pneumonia of right lower lobe. Anthracosis. Acute and subacute interstitial pneumonia. Chronic emphysema. Acute splenitis. Acute inflammation of adrenal glands. Cloudy swelling of liver, pancreas and kidney.

The body is opened by the usual longitudinal incision. A thick layer of yellow subcutaneous fat is present.

Chest. On opening the thoracic cavity the right lung is found adherent to the chest wall by a moderate number of old dense adhesions. The left pleural cavity contains about one liter of bloody fluid. The left lung is very small, occupying the lower and posterior part of the left pleural cavity. The heart and the space between the lungs are covered with an unusually large amount of fat. The parietal and visceral pleura on the left side are thickened and covered with a soft, jelly-like, mushy or stringy, grayish exudate which is covered with blood, giving the parietal wall, especially on its left lateral and posterior aspect, a ragged appearance. The left lung is adherent to the chest wall by this material, but is easily loosened.

The left pleura presents on its visceral surface many grayish-white, irregular areas of different size, measuring up to 7 cm. in diameter. They are not raised from the surface of the pleura. On cross-section they are not seen to invade the lung tissue. They are 1 to 2 mm. thick.

Lungs. The small left lung is entirely submerged in bloody fluid and is not seen when the chest is opened. It weighs 287 grams. Adhesions of the character described above are present between the lower lobe and the diaphragm, between the lung and the mediastinum, and between the lung and the chest wall. Its color is red like that of muscle, on the surface as well as on cross-section. It is firm to touch, crepitus is absent and pieces excised sink in water.

The right lung weighs 555 grams. Isolated, old, dense adhesions are present between the lung and the parietal wall. The adhesions are marked between the right lower lobe and the diaphragm; in loosening them the lung tissue is torn. Under the pleura many blackish areas of different size are seen (anthracosis). On section the upper lobe is crepitant, but is dark red and congested. Excised pieces float on water. From the cut surfaces a bloody, frothy fluid escapes. The lower lobe is of increased firmness; crepitus is present, but greatly diminished. On cross-section it is dark red in color and a bloody fluid, with some air bubbles in it, escapes on pressure. Excised pieces sink in water. No tumor metastases are seen or felt in the lung tissue.

Heart. The heart is hidden in an unusually large mass of lobulated, yellow fat, which is somewhat firmer than usual. The amount is so large that on first inspection the heart is not seen at all. The pericardial sac is completely obliterated, the parietal and visceral layers of the pericardium being firmly adherent to each other. On the left border of the heart a tumor is present. On account of the large amount of fat around the heart its borders and size cannot be made out. The tumor tissue is cystic in the incised area. A slightly cloudy fluid escapes from the incised cysts. One area in the center is broken down and a bloody and pus-like fluid escapes from it. The heart, with its vessels entering and leaving at the base, the right lung, the trachea and its bifurcating bronchi are removed *in toto* and dissected after having been hardened in formalin. From the hardened specimen the fat is removed and the tumor is found occupying the right border and the larger part of the posterior and the diaphragmatic surface of the heart. The lower border of the tumor is 5 cm. from the apex. The superior pole reaches up to the pulmonary artery, which arches over it (Fig. 1, *c*). The entire tumor in its largest diameters is 13 cm. long, 8 cm. wide and 5 cm. thick. The ascending aorta is anterior and to the right of its upper part. The left auricle is to the right of it and both ventricles are anterior to the lower part of the tumor. The lower surface which rests against the diaphragm measures 6 by 6 cm. This surface presents a ragged appearance after having been loosened from the diaphragm, due to the adhesions which have been broken up here.

The tumor consists of two portions (Fig. 1, *d*), a lower which forms part of a sphere and an upper one which is cone-shaped. Between these two portions is a constriction (Fig. 1, *e*). The lower part is the larger and projects from the surface of the heart, on which it rests by a large base.

On incising the tumor it is found to be sharply outlined. It is covered with pericardium. The latter is moderately thickened and its external surface is roughened. It is seen to consist of two layers which in most places can be easily separated. The tumor can be shelled out from this membrane like an orange from its peeling. (Fig. 1, *g*). In some places, especially in the inferior part of the tumor, the pericardial membrane is more firmly adherent to it.

The surface of the tumor, exposed under the pericardium, is smooth and of a white color. The line of demarcation of the tumor and the myocardium is also well defined, and the tumor tissue is differentiated from the myocardium by its color, consistency and general appearance. The color on cross-section is grayish-white. In some places it is soft in consistency and fat-like to touch in the fresh specimen; in other areas it is firmer. The cystic portion feels cartilage-like in the hardened specimen. These cystic cavities, which are present only in the lower part of the tumor (Fig. 2), are of variable size and shape and measure up to 1 cm. in diameter. In the center of the lower as well as in the upper portion are brownish-red areas of degeneration. They are most marked in the lower part, where one cavity is present, about 2 cm. in diameter, containing bloody, purulent fluid. The upper portion produces a bulging into the wall of the aorta, but leaves enough free space here to allow the circulation of the blood. No metastases are seen in the veins at the base of the heart. The myocardium is normal in color and general appearance. The wall of the left ventricle is 12 mm. thick. It is nowhere seen to be invaded by the tumor tissue.

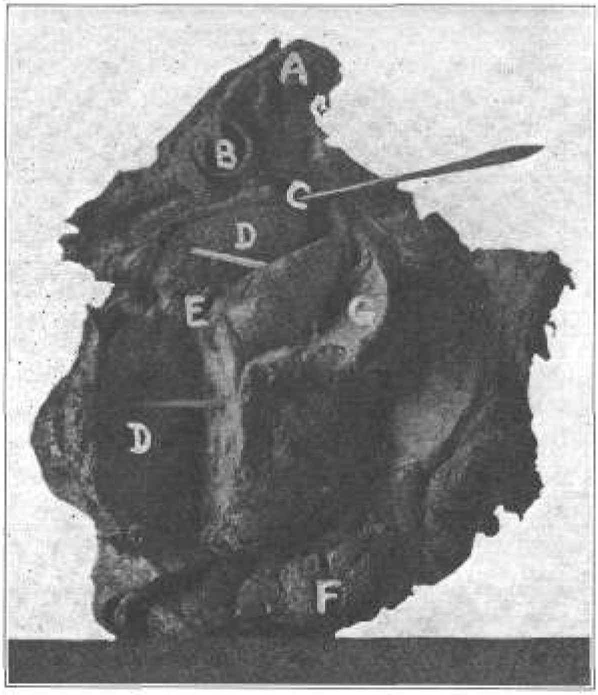

FIG. 1.—Photograph of posterior aspect of heart. *A*, trachea; *B*, bronchus; *C*, probe in pulmonary artery; *D*, the two lobes of the tumor with a constriction at *E*; the tumor is incised and the two halves pried apart by two pieces of wood; *F*, wall of left ventricle; *G*, the two layers of the pericardium peeled off from the tumor and reflected.

The endocardium is smooth and glistening. No tumor masses are present on it. The valves are smooth and competent. Only the aortic valve presents a slight thickening at the bases of the cusps.

Some yellowish, hardened patches are also seen in the ascending aorta.

The foramen ovale is closed except for a slit-like opening at the upper border of the fossa ovalis, but the layers of the endocardium are overlapping here, preventing the blood from flowing from the right auricle into the left.

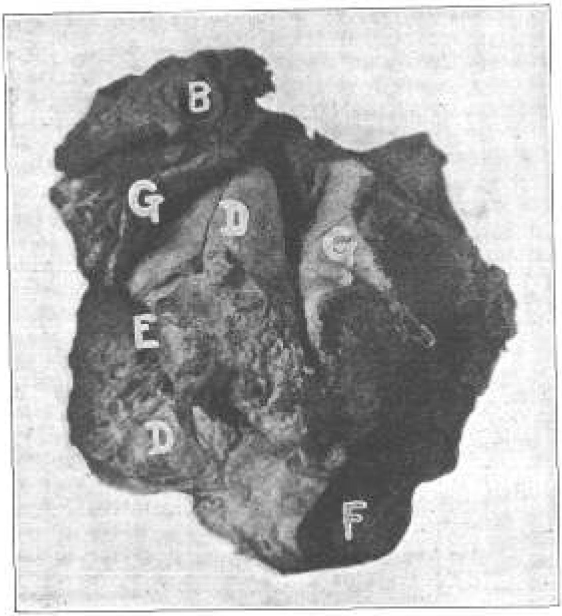

FIG. 2.—Shows the cystic degeneration of the lower part of the tumor which is laid open. *B*, bronchus; *D*, the lobes of the tumor, with a constriction at *E*; *F*, wall of left ventricle; *G*, the two layers of the pericardium peeled off from the tumor and reflected. This figure shows the cystic degeneration in the lower portion of the tumor.

The glands at the roots of the lung and in the mediastinum are not increased in size or number. The largest glands are about the size of a bean, and on macroscopic examination they were not considered to contain metastases.

The examination of the abdomen did not show anything of special interest. A large amount of fat was present on the large intestine, in the mesentery and retroperitoneally. There was no fluid in the abdomen. The abdominal organs appeared anemic. The liver tissue was of a yellowish color, suggesting fatty changes. It weighed 2170 grams. The spleen weighed 100 grams and appeared somewhat firmer than usual. The kidneys were pale and cloudy and weighed 200 and 190 grams respectively. The intestines were very anemic; pancreas, bladder, adrenals and prostate appeared normal. A thorough examination for a focus of tumor tissue in any other part of the body was made and no focus was found.

Microscopic Report. Heart. Sections from different parts of the tumor were examined. One section shows the relation of the myocardium and pericardium to the tumor. It is taken from a place where myocardium, pericardium and tumor tissue meet. A large portion of this section consists of myocardial muscle, which is cloudy and infiltrated by lymphocytes and pus cells. Some of the nuclei of the myocardial muscle are rather large and deeply stained. Next to the heart muscle is a layer of subepicardial fat, infiltrated by pus cells and lymphocytes. Peripheral to this is a zone consisting of fibrous tissue. In part of the section this layer is deflected. Here, next to the subepicardial fat, is tumor tissue, and the layer of fibrous epicardium and pericardium runs along the outer border of the tumor, so that the latter is bordered by pericardium on the one side and subepicardial fat on the other. Pericardial fat is peripheral to the pericardium, and it is richly infiltrated with tumor cells.

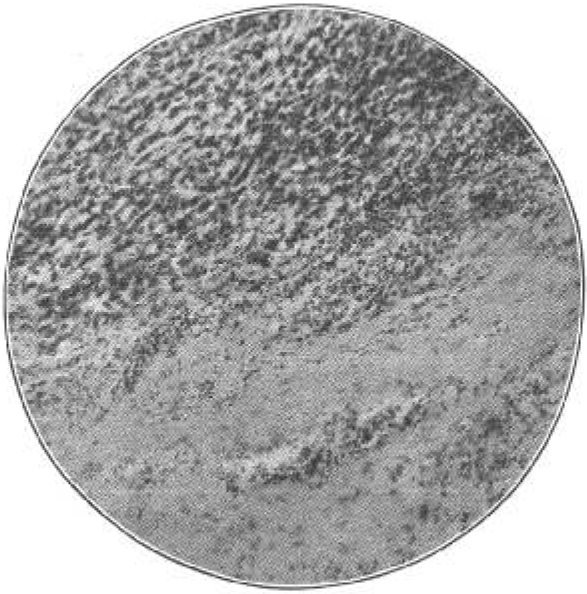

FIG. 3.—Photomicrograph of a section which is taken from the border of the tumor and includes a portion of the pericardium. There is a marked infiltration of small round cells, especially in the pericardium. Mayer's hemalum and eosin. Magnification, 140.

The pericardial tissue covering the myocardium and the tumor is diffusely infiltrated with large numbers of lymphocytes and a moderate number of pus cells. It contains many young small bloodvessels and cellular strands, consisting of spindle cells and lymphocytes. The connective tissue next to the tumor is hyaline-like and contains few nuclei (Fig. 3). In one area there is a small number of tumor cells in the pericardial connective tissue. Between the tumor and the pericardial connective tissue are large masses of lymphocytes. The tumor is made up of closely packed cells which are mostly oval, round or spindle shaped (Fig. 4). Their size varies, but most of them are rather large. Their nuclei are prominent, rich in chromatin and stained deeply blue. Abnormal mitotic figures are present. Most of the spindle-shaped nuclei have fibrillar protoplasm on both poles; around the round cells little or none is seen. The connective tissue is small in amount and the blood supply is poor. Large areas of the tumor tissue are necrotic. These areas are stained well with eosin, have a homogeneous appearance and contain much pyknotic nuclear material. The tumor tissue in this section and all the other sections examined is richly infiltrated with pus cells and lymphocytes.

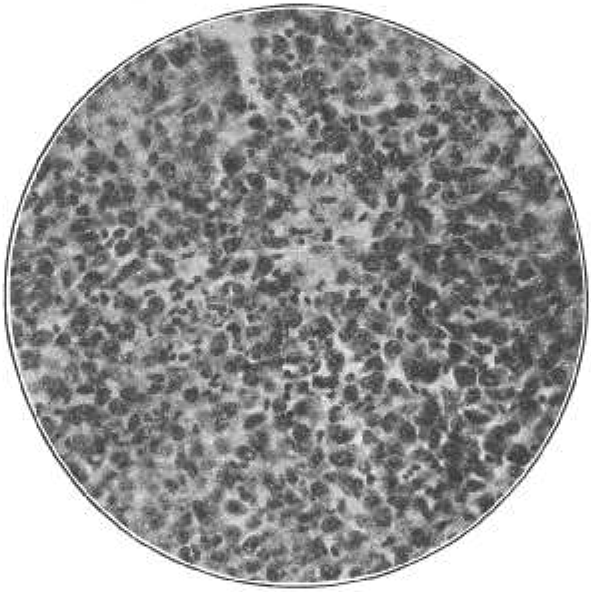

Fig. 4.—Photomicrograph of a section of the tumor showing the type of cells and the structure. Mayer's hemalum and eosin. Magnification, 285.

A section taken from the cystic area presents mostly necrotic tumor tissue. The cyst wall consists of necrotic tissue without nuclei. The cavity contains chiefly pus cells and red blood corpuscles. Large areas of pyknosis are present, and other areas, which are stained deeply with eosin, contain no nuclei.

In a section from that part of the tumor which rests against the diaphragm four zones are present. The first zone consists of tumor tissue, which is largely necrotic. The pericardial layer next to this divides and encloses a large area of tumor tissue, which appears to be in the obliterated pericardial cavity. Peripheral to this is the pericardial adipose connective tissue, richly infiltrated with tumor cells, and outside of this is necrotic sarcomatous tissue. The irregular torn adhesions of the diaphragmatic surface of the tumor are made up of sarcomatous tissue according to this section.

Myocardium. The surface of this section consists of a dense connective tissue, which is infiltrated by numerous lymphocytes and pus cells. In some regions two layers can be recognized, separated by fibrin and inflammatory exudate. These two layers correspond to the parietal and visceral epicardium and are fused together by inflammatory tissue. Beneath this layer is the subepicardial fat. The myocardial muscle contains moderate numbers of lymphocytes and leukocytes, especially in the bloodvessels. The cardiac muscle cells are cloudy. In one area this condition is pronounced, the muscle appears opaque and homogeneous and in some fibers the nuclei appear to be lost. No metastases were found in the myocardium in this section nor in any of the other sections which were examined.

Lung. Numerous leukocytes and lymphocytes are scattered throughout the sections. They are contained chiefly in the connective tissue of the alveolar septa and in the small bloodvessels. The alveoli contain air; some are distended and the septa between the alveoli are thinned or broken in places. Some of the air sacs contain serum with desquamated epithelial cells and a few leukocytes and lymphocytes.

In a section from the left lung taken from one of the grayish areas described in the gross examination the lung is covered by a thick layer of sarcomatous tissue. Peripheral to this is a thin layer of connective tissue, infiltrated with lymphocytes and containing numerous spindle nuclei and some leukocytes. The tumor cells are large and prominent, rich in chromatin, and appear to be younger than in the original tumor. No areas of degeneration are present.

The boundary of the tumor tissue is well-defined. Beneath it is inflammatory tissue which contains many young bloodvessels and young connective-tissue cells, and is infiltrated by numerous lymphocytes and leukocytes. So also is the underlying lung tissue. The alveoli are compressed. Few or no air spaces are present in some areas, the lung tissue being solid and compact and infiltrated by pus cells and lymphocytes. In other areas the air sacs are distended and the septa broken through. In none of the sections examined are any tumor cells found in the lung tissue.

A section made from the mushy soft material between the lung and the parietal wall shows this tissue to consist of the same elements as the original tumor.

Mediastinal Lymph Nodes. Sections from two lymph nodes were taken. Both consist chiefly of sarcomatous tissue, which has replaced the lymphoid tissue. Only in a few places near the capsule a small rim of lymphoid tissue is left. In one node the center is degenerating.

A section taken from the diaphragm includes the soft sarcomatous material between it and the heart. The diaphragm is not invaded with tumor cells.

Liver. The parenchymatous cells are cloudy and indistinct. They contain many fat globules of large size, and large areas of liver tissue are replaced by fat cells. Many pus cells are present, but they are chiefly contained in the sinusoids and vessels.

Spleen. The spleen is diffusely infiltrated with pus cells.

Pancreas. The bloodvessels contain many leukocytes. The parenchymatous tissue is cloudy.

Adrenals. The adrenal cells show degenerative changes. The medulla is richly infiltrated with lymphocytes and moderately with pus cells. The pus cells are numerous and in the bloodvessels. The large numbers of leukocytes found in the bloodvessels in the different organs is explained by the high white count, which three days before death was 122,000.

The microscopic examination proves that we have a sarcoma of the the mixed cell variety. The tumor is entirely pericardial. The myocardium is nowhere involved in the sections examined, which were taken from different places in the heart muscle. Microscopic examination as well as gross inspection shows that the tumor is covered by a membrane consisting of two layers, the visceral and parietal pericardium. The tumor is peripheral to the subepicardial fat, and it is probable that it originated in the subepicardial adipose tissue.

In two sections the pericardium covering the tumor contains sarcoma cells, but on its external surface a thin layer of sarcomatous tissue is present, making this surface irregular.

It is evident that the original tumor is the big tumor on the surface of the heart, and the tumor tissue found in the pericardium, pericardial fat, the pleura and in the mediastinal glands are metastases for the following reasons:

1. On account of the large size of the cardiac tumor and its well-defined structure.
2. It is the oldest of the sarcomatous tissue examined, as shown by the cystic, necrotic areas which are seen on microscopic and macroscopic examination.
3. The cells of the sarcomatous tissue in the pleura and lymph glands are younger in appearance, more active and do not present such marked degenerative changes.

DISCUSSION. It is a rather difficult undertaking to give a review of the literature of sarcoma of the heart, for some of the cases reported are obviously not sarcomas, and with others there is no proof that they are primary. Among the latter I count the case of G. Impacciante[18] and of Williams and Miller.[19] Both are cases of sarcoma of the mediastinum. In the latter case a tumor was found filling up nearly the entire chest cavity, adhering to the anterior surface of the heart, to the sternum and the diaphragm. In such a large general sarcoma of the mediastinum it is difficult to determine its origin. Other cases which are questionable as to their origin have been reported as primary sarcomas of the heart.

Some writers classify as sarcomas cases which are not reported as such, as the case of Zanders,[20] who reported a fibroma of the heart and remarked that in some places the cells were spindle-shaped, the structure approaching that of a spindle-cell sarcoma. Similarly, Crawfurd[21] reported a tumor of the heart, believing it to be a blood-clot, but stating that a sarcoma had to be considered.

Byrom Bramwell,[22] in 1875, reported a case of sarcoma of the heart, and later in his book on *Diseases of the Heart and Thoracic Aorta* corrected the diagnosis and stated that it was not a primary but a secondary tumor.

A myxosarcoma hematodes was reported by Wiegand.[23] Most writers class this case as myxoma. The same is to be said of Salvioli's[24] case. Prudhomme's[25] case, counted by Fraenkel as primary sarcoma, seems to have been a secondary melanotic sarcoma to judge from the clinical history and pathological description, but no microscopic examination was made. Of the cases reported in recent years, those of Méroz and Ménétrier appear doubtful to Thorel.[26]

Reviews of the literature have been made by Bodenheimer, Berenson, Fraenkel, Link, Karrenstein, Ehrenberg and others. In fact, nearly every writer who reports a new case mentions some of the cases which were previously reported. Ehrenberg, who gives the most complete review of sarcoma of the heart, in 1911, reported 19 cases. Two of his cases, those of Byrom Bramwell and Crawfurd, are not included in the following summary. There are some cases which are not controlable in a clinical or pathological respect, but it is difficult to know where to draw the line. In some the description is incomplete or unclear, in some the clinical description is not obtainable or no microscopic examination has been made. Birch-Hirschfeld's case is only mentioned.

Of the 30 cases which I was able to find in the literature only 3, including that of the author, are reported in American journals. The majority, 19 cases, are found in the German medical literature, 3 are English publications, 4 are reported in French, 1 in Italian and 1 in Swedish. It seems that tumor of the heart furnishes a favorite subject for dissertations for obtaining the M.D. degree. Eight cases among these 31 are reported as dissertations.

A correct clinical diagnosis was not made in any instance. Seven times the diagnosis of tumor of the mediastinum was made, once of intrathoracic tumor and once of cancer of the lung. Myocarditis was the diagnosis 4 times and pericarditis with effusion twice.

Besides these diagnoses a good many others were made which were not related to the heart disease, as encysted effusion and solidification of the lung, bronchopneumonia, edema of the lung, pleurisy with effusion, tuberculosis serosa, hemiplegia, bronchitis, scarlet fever, diphtheria, aneurysm, etc.

Sarcoma of the heart occurs at all ages. The two youngest were three and seven years old respectively; the oldest were seventy-two, seventy-six and seventy-nine years of age. All other patients were between the ages of eighteen and fifty-eight.

As regards the sex this disease apparently favors the male. Of our cases 18 were males and 10 females.

I am not able to give a detailed description and a complete picture of the clinical condition in the appended table on account of lack of space, and only mention those symptoms and signs which seem to me the most important, but it is evident that in the majority of cases the symptoms are produced by seriously disturbed cardiac activity. In most cases we find some of the following symptoms, venous congestion and stasis, cyanosis, pleural or pericardial effusion, edema of the legs and other parts of the body, edema of the lung, ascites, dyspnea, palpitation of the heart, irregular pulse, cough, etc. In only a few cases were heart murmurs heard. Repeated aspirations of bloody fluid from the pleural cavity were done only in Raw's and the author's cases. Repeated aspirations of bloody fluid from the pericardial cavity, which, according to Fraenkel, is of considerable diagnostic importance, was done only in his own case. Sudden death without previous symptoms occurred in 3 cases. In 21 cases the disease lasted from one month to three and a half years.

From a histological point of view there are:

Spindle-cell sarcomas	10
Round-cell sarcomas	6
Giant-cell sarcomas	4
Myxosarcomas	3
Fibrosarcomas	3
Mixed-cell sarcomas	2
Angiosarcoma	1
Lymphosarcoma	1

Eight cases of our series, including that of the author, are sarcomas of the pericardium. Of these Broadbent's case is apparently confined to the pericardium (only the chest was examined). In Drysdale's case and Lambert's case there was a general sarcomatous infiltration of the myocardium.

The cystic tumor reported by Kaak was in the upper part of the pericardium, connected with the pericardium and the large veins. Redtenbacher's angiosarcoma of the pericardium contained a cavity which was in communication with the right ventricle. In Schöppler's case there was a general sarcomatosis of the epicardium, the entire heart being enveloped in sarcomatous tissue. In Tobieson's case the tumor masses were mostly on the surface of the pericardium; these tumors were chiefly in the pericardial cavity or on the surface of the pericardium. The author's case seems to take a special place by taking its origin in the subepicardial areolar tissue, being covered by both layers of the pericardium.

The seat of the tumor was as follows:

	Cases.
Pericardium	8
Right auricle	11
Left auricle	6
Right ventricle	1
Right and left auricle	1
Ventricular septum	1
Aortic valve	1
Left ventricle and auricle	1

The size varied from that of a walnut to that of a child's head.

Metastases were found in 10 cases as follows:

	Cases.
In the liver	2
In the pancreas	2
In the lung	1
In the suprarenals	2
In the pleura and mediastinal lymph nodes	1
In the tracheal lymph nodes and suprarenals	1
In the lung and pararenal tissue	1

Among the postmortem findings, stasis due to interference with the circulation was the most common condition. Pleural effusion was found in 13 autopsies (four times bloody); pericardial effusion in 10 cases (five times bloody). The pericardium was partly or entirely obliterated 5 times.

SUMMARY OF REPORTED CASES.

No. 1. Baldwin, *Jour. Am. Med. Assn.*, 1910, lx, 635. Clinical diagnosis: Encysted effusion or solidification of bases of both lungs. Age and sex: thirty-four years; male. Main clinical symptoms: Dyspnea; edema of ankles; diffuse rales in both sides; flatness of both bases; bloody expectoration; cough; enlargement of heart. Düration and nature of tumor: Five months; large spindle-cell sarcoma. Location and size: Left auricle; 5 x 6 x 7 cm. Other postmortem findings: Organized blood-clot at base of left lung; dilatation of right side of heart. Remarks: A pedunculated tumor originating from the margin of the pulmonary veins. No metastases.

No. 2. Binder, *Frankfürter Ztschr. f. Path.*, 1914, xv, 194. Clinical diagnosis: Aneurysm; tumor of mediastinum. Age and sex: Thirty-three years; male. Main clinical symptoms: Dyspnea; edema of face, thorax, later of legs; venous telangiectasis of abdomen and thorax; no ascites. Duration and nature of tumor: Fifty days; spindle-cell sarcoma. Location and size: Right auricle; right auricle nearly filled. Other postmortem findings: Bilateral pleural serous effusion. Remarks: A tumor which is pedunculated, of the size of a walnut, hangs down from the right auricle into the vena cava. No metastases.

No. 3. Birch-Hirschfeld, *Lehrbuch der Path.*, 1876, p. 360. Nature of tumor: Giant-cell sarcoma. Location and size: Right auricle; walnut. Remarks: Origin in endocardium and right auricle. No other data.

No. 4. Bodenheimer, *Dissertation*, Bern, 1865. Clinical diagnosis: Heart disease of unknown origin. Age and sex: Forty-four years; male. Main clinical symptoms: Edema of upper and lower extremities; ascites; pericarditis with effusion; dulness of both bases; rales; sanguino-muco-purulent expectoration; sudden death. Duration and nature of tumor: Two months; sarcoma. Location and size: Right auricle mainly; 30 x 20 cm. Other postmortem findings: Pericarditis with effusion; right pleural effusion. Remarks: A tumor consisting of about 20 nodules on the anterior surface of the right and left auricle, growing into the cavity of the right auricle. No metastases.

No. 5. Broadbent, *Tr. Path. Soc.*, London, 1889, lxxxii, 39. Age and sex: Twenty-three years; male. Main clinical symptoms: Shortness of breath; signs of fluid in left chest and pericardium. Duration and nature of tumor: Three months; lymphosarcoma. Location: Pericardium. Other postmortem findings: Bloody pericardial effusion; fibrous pleurisy. Remarks: Pericardium 0.5 to 1.5 cm. thick; does not collapse after fluid is removed. No other part examined, but there did not seem to be any metastases.

No. 6. Crescenzi, *Monatschr. f. Kinderheilk.*, 1906–07, v, 369. Clinical diagnosis: Scarlet; diphtheria; bronchopneumonia. Age: Three years. Main clinical symptoms: Fever; scarlet eruption; diphtheria bacillus and streptococcus culture from throat; pharyngitis; bronchopneumonia. Duration and nature of tumor: Three months; sarcoma globocellulare. Location: Ventricular septum. Remarks: An intramural growth; does not reach endocardium. Tumor is in initial period of development. Posterior ventricular walls slightly infiltrated. No metastases.

No. 7. Drysdale, *Tr. Path. Soc.*, London, 1903, liv, 311. Age and sex: Forty-three years; female. Main clinical symptoms: Dyspnea; edema of legs; in state of collapse on admission; puerperal insanity; died after three days. Duration and nature of tumor: Eight months; round and oval-cell sarcoma. Location: Pericardium infiltrating myocardium extensively. Other postmortem findings: Obliterative pericarditis; pulmonary artery compressed. Remarks: Metastases in liver.

No. 8. Escher, *Dissertation*, Leipzig, 1909. Clinical diagnosis: Emphysema of lung; dilatation of heart. Age and sex: Seventy-two years; female. Main clinical symptoms: Shortness of breath; edema of legs; later edema of left arm and left chest. Duration and nature of tumor: One year; round-cell sarcoma. Location: Right auricle mainly. Other postmortem findings: Edema of legs;

arteriosclerosis; subpleural hemorrhage. Remarks: Pericardium obliterated and infiltrated with tumor tissue; tumor nodules on surface of pericardium. Metastases in tracheal lymph nodes and in suprarenal.

No. 9. Ehrenberg, *Deutsch. Arch. f. klin. Med.*, 1911, ciii, 293. Clinical diagnosis: Tumor of mediastinum, with compression of superior vena cava. Age and sex: Forty-nine years; male. Main clinical symptoms: Dyspnea; cyanosis; edema of upper half of body, head and upper extremities; enlargement of veins on upper abdomen and thorax; roentgen-ray; shadow to right of sternum. Duration and nature of tumor: Four months; polypoid giant-cell sarcoma. Location and size: Right auricle; right auricle filled. Other postmortem findings: Right pleural serous effusion; serous pericardial effusion. Remarks: Venæ cavæ, part of anonyma and azygos dextra filled by tumor tissue.

No. 10. Ely, *Thèse de Paris,* 1877, cited from Ehrenberg[4] and Méroz.[11] Age and sex: Twenty-eight years; male. Main clinical symptoms: Had been in hospital several times for bronchitis; died suddenly without sickness preceding death. Duration and nature of tumor: Sudden death; sarcoma. Location: Anterior wall of left ventricle. Remarks: No metastases.

No. 11. Erickson, *Upsala Läkarf. Förch.*, 1908, Band xiii, Hef; 6, cited from Méroz.[11] Clinical diagnosis: Myocarditis; bront chitis; pulmonary edema. Age and sex: Thirty-six years; male- Main clinical symptoms: Symptoms of myocarditis, bronchitis and pulmonary edema. Nature of tumor: Fibrosarcoma. Location: Left auricle. Remarks: A fibroma, with sarcomatous changes marked in places. No metastases.

No. 12. Fuhrman, *Dissertation,* Marburg, 1899. Age and sex: Seven years; female. Main clinical symptoms: Sudden death; had had a slight headache for two days. No other symptoms. Duration and nature of tumor: Sudden death; spindle-cell myxosarcoma. Location: Aortic valve. Remarks: Grape-like appearing tumors, obliteration of the right coronary artery by a tumor in front of it. Left coronary artery is occluded by a plug of tumor tissue. No metastases.

No. 13. Fuhrman (second case), *Dissertation,* Marburg, 1899. Age and sex: Thirty-four years; male. Main clinical symptoms: Palpitation of heart; cough; fatigue; weakness; frothy sputum; cyanosis; dyspnea; no edema; no murmurs. Duration and nature of tumor: Six months; spindle-cell sarcoma with giant cells. Location: Left auricle. Other postmortem findings: Left pulmonary vein obliterated by tumor. Remarks: This case had been reported as a myoma by Justi. Two tumors in the left auricle arising from the median and lateral wall. Small tumor the size of a bean on the mitral valve. No metastases.

No. 14. Fraenkel, *Festschr. zur Eröffnung d. Krankenhauses Hamburg-Eppendorf,* 1889, p. 102. Clinical diagnosis: Pericarditis, left serous; infarct in right lower lobe of lung. Age and sex: Eighteen years; female. Main clinical symptoms: Pericarditis with bloody effusion; pleurisy with serous effusion; dyspnœa; cyanosis; weak irregular pulse; bloody sputum; flatness in both lower lobes. Duration and nature of tumor: Fifty days; spindle-cell sarcoma. Location and size: Right auricle; 8 x 7 x 4.5 cm. Other postmortem findings: Atelectasis of left lower lung. 1.5 liters of serous fluid in the pericardium. Remarks: The pericardium was aspirated four times; 300, 1000, 80 and 750 c.c. of bloody fluid were obtained. No metastases.

No. 15. Fraenkel, *München. med. Wchnschr.*, 1901, No. 1, xlviii, 648 (summary). Main clinical symptoms: Symptoms of seriously disturbed cardiac activity. Nature of tumor: Mixed giant-cell sarcoma. Location: Apex of right ventricle. Remarks: No metastases.

No. 16. Geipel, *Zentralbl. f. allg. Path.*, 1899, x, 846. Age and sex: Fifty-three years; female. Main clinical symptoms: Left-sided apoplexy. Nature of tumor: Round-cell sarcoma. Location and size: Right auricle; 5.5 x 4.5 x 4 cm. Other postmortem findings: Pericardial cavity obliterated except for an area the size of the palm of the hand; destruction of last half of corpus striatum, the largest part of the internal capsule and insula. Remarks: Right auricle nearly filled by tumor, which is attached by a pedicle to the interauricular septum and adjacent area; right ventricle wall also infiltrated. No metastases.

No. 17. Horneffer and Gautier, *Revue méd. de la Suisse romande*, 1913, xxxiii, 57. Clinical diagnosis: Bronchitis; cardiorenal disease; myocarditis. Age and sex: Forty-three years; male. Main clinical symptoms: Symptoms of bronchitis for two years; bloody sputum; dizziness; weak limbs; vertigo; fainting spells; arrhythmia; murmurs at base of heart; dyspnea. Duration and nature of tumor: Two years intermittently; myxosarcoma. Location and size: Left auricle; 6 x 5 x 2 cm. Other postmortem findings: Pericardial effusion; right pleural effusion. Remarks: Cauliflower-like pedunculated growth reaching down to mitral valve and sending prolongations through it. The tumor grows through the auricle wall appearing on its surface. No metastases.

No. 18. Hottenroth, *Dissertation*, Leipzig, 1870. Clinical diagnosis: Chronic bronchitis; pleural effusion. Age and sex: Seventy-nine years; female. Main clinical symptoms: Marantic and emaciated; various kinds of rales; signs of fluid in chest. Nature of tumor: Giant-cell sarcoma. Location and size: Right auricle; hen's egg. Other postmortem findings: Right auricle dilated; vena cava dilated. Remarks: Growth is cauliflower-like. No metastases.

No. 19. Juergens, *Berl. klin. Wchnschr.*, 1891, xxviii, 1031. Age and sex: Thirty-sex years; male. Duration and nature of tumor: Sudden death on street; fibrosarcoma. Location: Right auricle mainly. Other postmortem findings: Tricuspid valve narrowed. Remarks: Diffuse infiltration of wall of right auricle, tendons of tricuspid valve and wall of right ventricle.

No. 20. Kaak, *Dissertation,* Kiel, 1904. Clinical diagnosis: Myocarditis with marked disturbance in compensation. Age and sex: Twenty-seven years; male. Main clinical symptoms: Cough and pain in both axillæ; dyspnea; edema of legs, back and eyelids; ascites; dulness at bases of both lungs; pleuritic friction rub. Duration and nature of tumor: Four weeks; myxocystosarcoma. Location: Pericardium. Other postmortem findings: Two hemorrhagic infarcts in lung; edema of bases of lungs; bilateral pleural effusion; ascites; edema. Remarks: The tumor is in the upper part of the pericardial cavity connected with the pericardium and large vessels. It is partly cystic; one large cyst, 11 cm. long, hangs down from the lower portion of the tumor. Two thoracenteses done, 1700 c.c. of yellowish fluid at second aspiration.

No. 21. Lambert, *New York Med. Jour.,* 1898, lxvii, 210. Clinical diagnosis: Pneumonia; pericardial effusion; bilateral pleurisy, with effusion; mediastinal tumor at root of right lung. Age and sex: Thirty-nine years; male. Main clinical symptoms: Signs of pneumonia, which only partly cleared up; developed bilateral serous effusion; cyanosis; ascites; pericardial effusion; edema of upper part of body. Duration and nature of tumor: Thirty-seven days; small round-cell sarcoma. Location: Visceral surface of pericardium; myocardium diffusely infiltrated. Other postmortem findings: Fibrinous pericarditis, with bloody effusion. Remarks: Nodular growth covers inner surface of pericardium; wall of left ventricle extensively infiltrated; nodules in other parts of myocardium. Metastatic nodule in head of pancreas.

No. 22. Link, *Ztschr. f. klin. Med.,* 1909, lxii, 272. Clinical diagnosis: Tumor of mediastinum. Age and sex: Twenty-three years; male. Main clinical symptoms: During the twenty months preceding death he was four times in the hospital with dyspnea, pain in the heart region, cough, cyanosis, pericarditis, pleural effusion; last time had edema, thrombosis of external jugular vein bloody sputum. Duration and nature of tumor: Twenty-one months; spindle-cell sarcoma. Location and size: Right and left auricle; heart and tumor were size of a child's head. Other postmortem findings: Pericardial cavity mostly obliterated; bilateral pleural effusion. Remarks: Upper border of the tumor, which is at innominate vein, measures 15 cm. Almost nothing is left of the walls of the auricle. The walls of the ventricle are preserved. Roentgen-ray showed increase in shadow of heart to right and left in upper part.

No. 23. Ménétrier, *Acad. de méd. de Paris,* March 7, 1911 (cited from *Zentralbl. f. Herzkrank.,* iii, 208.) Age and sex: Thirty-five years; male. Main clinical symptoms: Edema of body below diaphragm; dyspnea; bloody pleural effusion; hemoptysis. Nature of tumor: Myxosarcoma, with fusiform cells. Location and size: Left auricle; 6 cm. Other postmortem findings: Infarcts in lung; hemorrhagic effusion in pleural cavity. Remarks: Tumor compresses right auricle and interferes with circulation. Edema entirely below diaphragm suggests compression of inferior vena cava.

No. 24. Méroz, *Thèse,* Geneva, 1911. Clinical diagnosis: Mitral regurgitation; left pleurisy; cancer of lungs. Age and sex: Fifty-five years; female. Main clinical symptoms: Pain in left side; pain on respiration; dyspnea; scattered rales and dulness; mitral regurgitation; systolic murmur; pleural effusion; edema of lungs. Duration and nature of tumor: Two months; spindle-cell sarcoma. Location and size: Left auricle; hen's egg. Other postmortem findings: Left pleural cavity contains 2000 c.c., and pericardium 100 c.c. of purulent fluid. Remarks: The tumor hangs down into the left ventricle through the enlarged mitral valve. No metastases.

No. 25. Raw, *British Med. Jour.,* 1898, ii, 1335. Clinical diagnosis: Tumor of mediastinum. Age and sex: Forty-three years; female. Main clinical symptoms: Continual pain in chest for three and one-half years; dyspnea; ascites; edema of legs; dulness in right chest; outward displacement of heart; hemothorax; murmur at base of heart. Duration and nature of tumor: Three and a half years; fibrosarcoma. Location and size: Right auricle 3 x 3 x 3¼ cm. Other postmortem findings: Bacillus aërogenes capsulatus in blood; lumbar veins enlarged; inferior vena cava nearly empty. Remarks: Repeated aspirations of thorax gave bloody fluid from chest. Growth extends continuously from right auricle through inferior vena cava to under surface of liver. Microscopically it appears as fibroma, containing clusters of round cells; this and metastasis in liver suggests fibrosarcoma.

No. 26. Redtenbacher, *Wien. klin. Wchnschr.,* 1889, ii, 214. Clinical diagnosis: Serous membrane tuberculosis. Age and sex: Twenty-two years; male. Main clinical symptoms: Symptoms of pericarditis; frothy expectoration; effusion into both pleural sacs; later into abdomen; dyspnea and hydrops very marked. Duration and nature of tumor: Four months; angiosarcoma of pericardium. Location and size: Pericardium; palm of hand. Other postmortem findings: The abdomen contains 6 liters, the right pleural cavity ½ liter, the left 2 liters of serous fluid; the heart 100 c.c. of bloody fluid; the pericardium is adherent to the heart except at the apex. Remarks: Over right auricle and part of right ventricle is a blood-containing cavity communicating with right ventricle. Metastases in right lung.

No. 27. Schoeppler, *München. med. Wchnschr.,* 1906, xlv, 2197. Clinical diagnosis: Hemiplegia. Age and sex: Seventy-six years; female. Main clinical symptoms: Unconscious on admission; demented and delirious; pericardial friction rub; systolic murmur at apex; right-sided paralysis, which disappeared. Nature of tumor: Round-cell sarcoma of epicardium. Location: Covers entire heart. Other postmortem findings: Fibrinous pericarditis. Remarks: Died three months, twenty-four days after admission; no history obtainable; the entire heart is enveloped in nodular irregular sarcomatous tissue. Metastasis on left surface of suprarenal.

No. 28. Sternberg, *Zentralbl. f. Herzkrank.*, 1910, ii, 151. Clinical diagnosis: Myocarditis. Age and sex: fifty-eight years; female. Main clinical symptoms: Dyspnea; edema of ankles; enlargement of heart; incomplete examination on account of low condition of patient. Duration and nature of tumor: Two months; spindle-cell sarcoma. Location: Wall of left ventricle; in right and left auricles. Other postmortem findings: Hemorrhagic fluid in right pleural cavity; infarct in lung; hemorrhagic pericardial effusion: Thrombosis of many branches of pulmonary artery. Remarks: Vena magna cordis filled with tumor tissue which projects like a polypoid growth into right auricle. A large tumor nodule in left auricle grows out of right pulmonary vein, which is completely filled with tumor tissue. Metastasis in tail of pancreas.

No. 29. Tobieson, *Ztschr. f. klin. Med.*, 1912, lxxv, 53. Clinical diagnosis: Intrathoracic tumor. Age and sex: Eighteen years: male. Main clinical symptoms: Irregular heart; fever; friction rub over nipple; cough; decreased breathing beneath scapula; enlargement of heart; systolic murmur at pulmonary region; thrombosis of jugular vein; edema; cyanosis; dyspnea; pleural effusion; gangrene of nose. Duration and nature of tumor: Nine months; spindle-cell predominating. Location and size: Internal surface of pericardium; man's head. Other postmortem findings: Bilateral pleural effusion (bloody); pericardium filled with coagulated blood. Remarks: The tumor masses mostly on the internal surface of the pericardium are flat or nodular; the vena cava superior is completely compressed and no lumen is left. Metastases in lung.

No. 30. Weiss, *Gazz. med. ital. Prov. Venete,* 1880, xxiii, 301. Clinical diagnosis: Tumor of anterior mediastinum; compression of pulmonary artery and descending vena cava. Age and sex: Thirty-eight years; male. Main clinical symptoms: Cyanosis; edema of upper part of body, head and upper extremities, especially the left side; decreased pericardial dulness; dulness at bases of lungs; cardiac palpitation; dyspnea; left pleural effusion. Duration and nature of tumor: Thirty-four days; large round cell predominating. Location and size: Right auricle mainly; child's head. Other postmortem findings: Edema of upper part of body, lung and cerebrum; thrombus of descending vena cava; interstitial hepatitis; obliterated pericardium; bilateral serous pleural effusion. Remarks: The tumor with the heart and the obliterated pericardium formed a large mass the size of a child's head. The tumor was mainly in the right auricle and had broken through the interauricular septum; myocardium of right auricle largely replaced by tumor tissue, that of the other chambers extensively infiltrated. Tumor masses enveloped the heart. Metastases in lung and pararenal tissue.

No. 31. Perlstein. Clinical diagnosis: Tumor of mediastinum. Age and sex: Forty-three years; male. Main clinical symptoms: Dyspnea; cough; perspiration; restlessness; thirst; weakness; hemothorax. Duration and nature of tumor: Thirty-one days; Mixed-cell sarcoma. Location and size: Pericardium; 13 x 8 x 5 cm. Other postmortem findings: Chronic obliterative pericarditis; hemothorax; anemia; interstitial pneumonia; lobar pneumonia; chronic emphysema. Remarks: A well-defined tumor originating in the subepicardial adipose tissue located essentially between heart and epicardium, invading the pericardial membranes and fat. The myocardium is not invaded. Metastases in mediastinal lymph nodes and in pleura.

CONCLUSIONS. 1. Only 30 cases of sarcoma of the heart were found after a careful search of the literature. To these is added a case in which the tumor originated apparently in the subepicardial areola tissue.

2. There is no characteristic clinical picture for the condition. The symptoms are mostly those of seriously disturbed cardiac activity. Excessive and repeated hemothorax was the most striking clinical feature of the case reported.

3. Sarcomas of the heart occur at all ages, but are most common in the vigorous years of life.

4. Histologically all types of sarcoma have been reported. The spindle-cell variety is the one most often found.

5. They occur more often in the auricles than in the ventricles, and more frequently on the right than on the left side.

6. Among the postmortem findings, pericardial and pleural effusions and edema are common.

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STUDIES IN CHOLELITHIASIS.

I. THE DISTURBANCES OF THE CHOLESTERIN METABOLISM AS A FACTOR IN GALL-STONE FORMATION.

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IN this communication our present knowledge of the cholesterin metabolism is summarized and the importance of a hypercholesterinemic state both in the blood and bile as an etiological factor in the production of gall-stones is emphasized. The various elements in gall-stone formation are studied. These are the relationships of food to the cholesterin content of the blood and bile and the effect of bacterial infection and of an unknown variable factor which in a later communication will be discussed under the term of "cholesterin diathesis."

BILE. The chemical composition of bile has been investigated by numerous workers and the relative proportions of its various constituents have been found to be variable. This is readily explained when one analyzes the chemical methods in use during earlier periods as well as the various factors present in the individual cases at the time the analyses were made. Necessarily for this purpose biliary fistulæ of one kind or another must be made, and these immediately introduce abnormal factors. In addition, in practically all of the cases studied, pathological conditions have existed. Frerichs[1] examined the bile of two healthy people who had been killed accidentally; von Gorup-Besanez[2] examined the bile of a man, aged forty-nine years, and of a woman, aged twenty-nine years. Hammersten[3] examined the human liver bile in 3 cases.

[1] Hoppe-Seyler: Physiologische Chemie, p. 299.
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[3] Physiological Chemistry, English translation, New York, 1906.